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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/734,197	12/15/2003	Chin-Cheng Chien	025796-00013	4786

7590

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ARENT FOX KINTNER PLOTKIN & KAHN, PLLC

Suite 400

1050 Connecticut Avenue, N.W.

Washington, DC 20036-5339

EXAMINER

DUONG, KHANH B

ART UNIT

PAPER NUMBER

2822

DATE MAILED: 11/12/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/734,197

Applicant(s)

CHIEN ET AL.

Examiner

Khanh Duong

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Am

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 15 December 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-20 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 15 December 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Response to Amendment

This Office Action is in response to the filing of the application on December 15, 2003.

Accordingly, claims 1-20 are pending in the application

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in-

- (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effect under this subsection of a national application published under section 122(b) only if the international application designating the United States was published under Article 21(2)(a) of such treaty in the English language; or
- (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that a patent shall not be deemed filed in the United States for the purposes of this subsection based on the filing of an international application filed under the treaty defined in section 351(a).

Claims 1 and 2 are rejected under 35 U.S.C. 102(e) as being anticipated by Lee et al. (KR2002080953A).

Re claims 1 and 2, Lee et al. ("Lee") discloses in the Abstract (see also the attached drawing) a method of surface pretreatment before selective epitaxial growth process, comprising: providing a semiconductor substrate 101 having metal-oxide-semiconductor devices formed thereon; performing a dry etching process with a carbon-free plasma source (SF₆) to remove a portion of said semiconductor substrate 101; and performing a selective epitaxial growth process to form a semiconductor layer on said semiconductor substrate 101. Since Lee discloses the use of a plasma source containing SF₆, it should be inherent that such plasma source is diluted with an ambient gas as a carrier gas.

Claims 1-3 are rejected under 35 U.S.C. 102(e) as being anticipated by Murthy et al. (US 6,541,343).

Re claims 1-3, Murthy et al. ("Murthy") disclose in FIG. 2 to 7 a method of surface pretreatment before selective epitaxial growth process, comprising: providing a semiconductor substrate 201 having metal-oxide-semiconductor devices formed thereon; performing a dry etching process with a carbon-free plasma source (SF₆ diluted with ambient gas comprising He) to remove a portion of said semiconductor substrate 201; and performing a selective epitaxial growth process to form a semiconductor layer 216 on said semiconductor substrate 201 [see col. 5, ln. 18-59].

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claims 4, 6, 8 and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lee.

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Re claims 4, 6, 8 and 9, Lee discloses a dry etching process with the carbon-free plasma source as discussed above but fails to disclose the specific ranges of process parameters for volume ratio, pressure, power, time and thickness as claimed.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the process of Lee by selecting specific ranges of process parameters as claimed, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or working ranges involves only routine skill in the art. *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955).

Claims 4-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Murthy.

Re claims 4-9, Murthy further discloses the dry etching process at a pressure between 200 to 300 mTorr and a power between 25 to 100 Watts [see col. 5, ln. 23-32]. However, Murthy fails to disclose the specific ranges of process parameters for volume ratio, pressure, power, time and thickness as claimed.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the process of Murthy by selecting specific ranges of process parameters as claimed, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or working ranges involves only routine skill in the art. *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955).

Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Lee in view of Kodama (US 5,953,605).

Re claim 10, Lee discloses a method substantially as claimed but fails to disclose a baking process performed with hydrogen ambient gas at a temperature less than 750°C prior to said selective epitaxial growth process.

Kodama suggests in FIG. 4A to 4C a baking process performed with hydrogen ambient gas at a temperature less than lower than or equal to 800°C prior to said selective epitaxial growth process completely remove the natural oxidation layer [see col. 8, ln. 8-15].

Since Lee and Kodama are both from the same field of endeavor, the purpose disclosed by Kodama would have been recognized in the pertinent prior art of Lee.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the baking process of Kodama to the process of Lee since such modification would completely remove the natural oxidation layer as discussed above.

Furthermore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to select a temperature range within the range as taught by Kodama, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or working ranges involves only routine skill in the art. *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955).

Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Murthy in view of Kodama (US 5,953,605).

Re claim 10, Murthy discloses a method substantially as claimed but fails to disclose a baking process performed with hydrogen ambient gas at a temperature less than 750°C prior to said selective epitaxial growth process.

Kodama suggests in FIG. 4A to 4C a baking process performed with hydrogen ambient gas at a temperature less than lower than or equal to 800°C prior to said selective epitaxial growth process completely remove the natural oxidation layer [see col. 8, ln. 8-15].

Since Murthy and Kodama are both from the same field of endeavor, the purpose disclosed by Kodama would have been recognized in the pertinent prior art of Murthy.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the baking process of Kodama to the process of Murthy since such modification would completely remove the natural oxidation layer as discussed above.

Furthermore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to select a temperature range within the range as taught by Kodama, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or working ranges involves only routine skill in the art. *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955).

Claims 11-17, 19 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wu (US 6,190,977) in view of Murthy.

Re claims 11-20, Wu discloses in FIG. 1 to 7 a method of forming a semiconductor device using selective epitaxial growth, comprising: providing a semiconductor substrate 10 with a first conductivity; forming a plurality of isolation regions 12 on said semiconductor substrate 10; sequentially forming a gate dielectric layer 14 and a gate electrode 16 on said semiconductor substrate 10 between each pair of said isolation regions 12; forming a lightly doped drain region 30 with a second conductivity opposite to said first conductivity in said semiconductor substrate 10 between said gate electrode 16 and each said isolation region 12; forming a second spacer 22

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around said gate dielectric layer 14 and said gate electrode 16; forming a first spacer 24 around said gate dielectric layer 14 and said gate electrode 16; forming a source/drain region 28 with said second conductivity beside said lightly doped drain region 30; performing a selective epitaxial growth process to form a semiconductor layer 26 on said semiconductor substrate 10; forming a metal layer (Ti, Co, Ni or Pt) on said semiconductor layer 10; and performing a salicide process to form a silicide layer 32a and 32b on said semiconductor substrate 10 [see col. 3-6].

Re further claims 11-13, Wu fails to disclose performing a dry etching process with a carbon-free plasma source to remove a portion of said semiconductor substrate.

Murthy suggests in FIG. 2 to 3 performing a dry etching process with a carbon-free plasma source (SF_6 diluted with ambient gas comprising He) to remove a portion of said semiconductor substrate 201 for the purpose of cleaning the surface of the substrate 201 prior to forming a silicon epitaxial layer 216 [see col. 5, ln. 18-32 and 55-60].

Since Wu and Murthy are both from the same field of endeavor, the purpose disclosed by Murthy would have been recognized in the pertinent prior art of Wu.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the dry etching process of Murthy in the process of Wu because of the desirability to provide the substrate with a clean surface free of contaminants prior to growing the epitaxial silicon layer.

Re further claims 14-17, Murthy further discloses the dry etching process at a pressure between 200 to 300 mTorr and a power between 25 to 100 Watts [see col. 5, ln. 23-32].

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However, Murthy fails to disclose the specific ranges of process parameters for volume ratio, pressure, power, time and thickness as claimed.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the combined process of Wu and Murthy by selecting specific ranges of process parameters as claimed, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or working ranges involves only routine skill in the art. *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955).

Claim 18 is rejected under 35 U.S.C. 103(a) as being unpatentable over Wu and Murthy as applied to claims 11-17, 19 and 20 above, and further in view of Kodama.

Re claim 18, Wu and Murthy disclose a combined process substantially as claimed, however, Wu and Murthy fail to disclose a baking process performed with hydrogen ambient gas at a temperature less than 750°C prior to said selective epitaxial growth process.

Kodama suggests in FIG. 4A to 4C a baking process performed with hydrogen ambient gas at a temperature less than lower than or equal to 800°C prior to said selective epitaxial growth process completely remove the natural oxidation layer [see col. 8, ln. 8-15].

Since Wu, Murthy and Kodama are all from the same field of endeavor, the purpose disclosed by Kodama would have been recognized in the pertinent prior art of Wu and Murthy.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the baking process of Kodama to the combined process of Wu and Murthy since such modification would completely remove the natural oxidation layer as discussed above.

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Conclusion

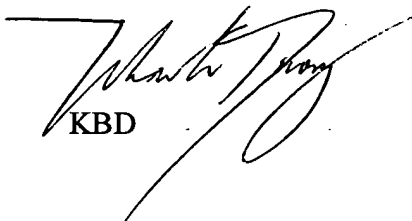
The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Rotondaro et al. (US 6,214,736) discloses in FIG. 7A to 7C performing a plasma process to clean the substrate surface prior to forming an epitaxial source/drain layer.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Khanh Duong whose telephone number is (571) 272-1836. The examiner can normally be reached on Monday - Thursday (9:00 AM - 6:00 PM).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amir Zarabian can be reached on (571) 272-1852. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



KBD



AMIR ZARABIAN
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2000